

Rehabilitation After Stroke

Emphasis on Usefulness in Restoration of Function

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UNTIL FIFTEEN YEARS AGO the treatment of patients with stroke was considered to be mainly a nursing problem and one that did not require much planning, supervision or active management by the physician. Patients who could make some spontaneous recovery would get out of bed, walk in whatever way they could and perhaps even learn to care for themselves. What treatment there was, was watchful and prayerful waiting and pleasant surprise if the patient did show enough recovery to do anything.

Now we have come to a quite different medical attitude: "Get 'em up and going," or, more formally, early mobilization. The sequelae of immobilization of healthy persons has been shown to be (1) nitrogen loss, with consequent loss of muscle tissue, (2) atrophy, as shown by smaller size of extremities, (3) calcium loss, leading to osteoporosis and renal stones, (4) phosphorus loss, (5) stiffness and soreness of joints, (6) deterioration of standing reflexes, (7) impairment of circulation, (8) decrease in blood volume, (9) increased generalized weakness, (10) profound psychological changes.

Thus the disability resulting from immobilization following stroke can be greater than that caused by damage to the brain. All too often the effects of immobilization complicate the neuromuscular disabilities and minimize the chances of functional recovery.

Early mobilization is simple, is physiologically sound and requires no expensive apparatus. If necessary, it can be carried on at the patient's home and by members of his own family if they are properly instructed.

In the acute stage, the nursing care consists of nutrition, bowel and bladder care, skin care, and proper bed positioning and body alignment.

Besides food, adequate intake of fluids is necessary. Inasmuch as many of the patients cannot request fluids and do not help themselves, this is often neglected, fluids being given only at mealtime and in small amounts. Patients should be encouraged to feed themselves as soon as possible. Beginning the day they are strong enough to sit up and eat, they should raise food to their mouths,

• The physical treatment of patients with paralysis after stroke is not a casual prescription of exercise but involves an evaluation of the patient from the mental and sensorimotor standpoint to determine his disabilities and abilities. This is necessary to prescribe and direct a precise form of activity and functional exercises that will promote a return of functional patterns of movement useful to the patient for his independence.

using the hand not affected by the stroke if necessary to obviate being fed.

In many patients "incontinence" is due to inability to request the urinal or the bed pan rather than to neurogenic impairment of sphincter control. Far too often in such circumstances a catheter is inserted for the convenience of the nurses to keep the bed dry. Keeping the bed clean may prevent difficulties with the skin, but catheterization creates other problems which in the end may be much more severe. Not only is there a likelihood of bladder infection, but with a retention catheter long in place the patient loses all bladder sensation, even of duty to be clean, and dispensing with it later becomes difficult. Bowel training also can be started even if the patient cannot speak his need. The use of glycerin suppositories, mild laxatives and a regular evacuation time can accomplish bowel training in many of the most mentally dull patients.

Although avoiding decubitus ulcers depends largely on keeping the bed dry and changing the position of patients frequently, often they are left to lie in one position for the convenience of the nursing staff. They should be turned on either side from time to time; and, ideally, should even lie prone occasionally, although this is a difficult position for most elderly people.

The proper bed positioning and body alignment involves the use of a foot board or a right-angle dorsiflexion splint or cast to prevent foot drop and tightening of the heel cords as well as to stimulate extensor muscle responses by plantar pressure. If such a splint or cast is used, the extremity must be removed several times a day in order to avoid ulceration on the heel. External rotation of the leg should be prevented also. The upper extremity may be supported by the use of pillows, with the ideal

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position of abduction at 90°, neutral rotation, elbow extended to 150° and hand and fingers supported in neutral or slight extension. A cock-up splint may be put on the hand or wrist but it must be removed at least twice daily in order to prevent deformities conforming to the splint. The use of an overhead orthopedic frame with trapeze is useful to encourage the patient to use his remaining arm and leg to move himself about the bed.

DISTURBANCES OF FUNCTIONS

As with the medical treatment of most diseases, the physical rehabilitation of the stroke patient is the treatment of symptoms. This is not a matter of dealing with a muscle paralysis as in poliomyelitis, but with a form of brain damage which often involves sensation and mental processes as well as motor handicaps. Thus, hemiplegic patients not only have neuromusculoskeletal problems but also disturbances in mental function that may involve their behavior, their language formulation or their reasoning powers. The amount of mental damage may be the major factor in determining functional recovery, irrespective of the motor damage.

Disturbance of mental function may be evident in many ways if it is searched for. There may be disorientation, memory impairment, emotional lability, short attention span, dementia, and denial of the presence of the involved limbs. There may be also various agnosias and apraxias. Aphasia may be complete, the patient neither understanding words nor being able to say them. Or it may be any of a number of variants; for example, the patient may understand speech but be unable to formulate words. There also may be forms of agnosia in which the patient does not recognize objects by their feel. He may also have apraxia in which he does not recognize what to do with objects.

Frequently there is a disturbance of sensation on the involved side. This may be expressed as a diminution of touch and pain. This is much more frequently found in left-sided hemiplegia. A more difficult thing to test is loss of proprioception; and it is of considerable importance when it is found. It can manifest itself by gait disturbance or by poor use of the hand when there is sufficient motor power. Visual field deficits, frequently concomitants of stroke, will also influence gait and use of the hands.

The most obvious handicap, of course, is that of disturbance of motor power. This may be present either as monoplegia, hemiplegia or double hemiplegia, depending upon the severity and site of the stroke. The muscle tone itself is altered, causing flaccidity or spasticity or rigidity. Occasionally, dystonic or dyskinetic movements are present.

Before one can begin treatment, an assessment must be made of the patient's abilities and dis-

abilities in all the spheres that have been mentioned. The degree of sensorium loss is important in knowing how cooperative the patient is and will be and, thus, in determining what specific rehabilitation program might be followed. The fact that a patient is still disoriented does not necessitate deferring all treatment but it does mean planning an entirely different approach. This involves an explanation both to his family and to the nurses and therapists attending him. Again, the approach to this problem will vary with an individual patient. Some may need sedation and avoidance of any external stimuli, necessitating that they be in a private room or away from other noisy patients, or away from activity or pressure of any sort. Others, who may be withdrawn, may need the stimulation of much activity going on about them, forcing them into group activities and into the environment again. For example: In one hospital that has an active occupational therapy department, approximately 30 patients are taken to the department daily, only 15 of them participating in activities there, yet the others are more alert and more cooperative in their nursing routines afterward, for they enjoy the experience even if it is only watching others being busy. It is, of course, important to analyze the degree of mental impairment lest the planned exercise or activities be beyond the frustration point of the patient, which could bring on emotional problems and an antagonism to any form of therapy.

Dealing with speech problems requires much explanation both to the attending nursing staff and to the family. Aphasia usually occurs with involvement of the dominant side of the brain. Like any other form of damage, it varies from mild to severe, and the prognosis varies accordingly. Speech therapy in aphasia problems due to strokes caused by vascular disease is still of limited value, at least with the usual methods of speech training. As a general rule, patients who have an adequate sensorium and have not shown any spontaneous recovery within a six-week period have a dismal prognosis in this regard. One must understand that aphasia is only one aspect of the problem of language formulation, which also involves reading and writing. As these various factors may be affected in different degrees, they should be tested individually.

The disturbance of sensation on the involved side is something which has been too little appreciated in the past. This is particularly true in so-called mild strokes, in which there may be only a minimal amount of muscle weakness and paralysis and yet the patient has poor functional use of the involved arm or leg. One must understand that this is not merely a matter of diminution of sensation of pain and touch but is more in the disturbance of

proprioception, which often mediates the inhibition or facilitation of neuromuscular responses so as to give effective coordination and smooth synergy of movement to a limb. It is only in recent years that this has been given greater emphasis in our exercise program and given us better understanding of the value of certain exercises over others.

PHYSICAL THERAPY

The physical treatment is usually designated as "physical therapy" and it is important to know the "whys and the why nots" of various modalities in this field.

(a) The use of heat is seldom necessary or effective. Heat has only the purpose of improving local circulation or lessening the sensation of pain. Unless the patient does have a painful joint, which usually results from prolonged inactivity, applying heat has no value.

(b) Massage is greatly misunderstood. Massage cannot restore muscle power. It is useful only when local edema is present. It may have some psychological value for the patient or his family but can have no physiological benefit.

(c) Stretching is a form of passive exercises. Muscles that are beginning to become contracted enough to cause deformities of joints undoubtedly will have to undergo periodic stretchings during the day. Sometimes it is necessary to overstretch a muscle because its spasticity is greater than that of its antagonist. For example, the plantar flexor of the leg usually has more spasticity than the dorsiflexors and, likewise, the finger flexors more than the finger extensors. The overstretching is done by putting on splints or bracing.

(d) Electrical stimulation of the muscles has a limited application. It will cause contraction of the muscles stimulated, but as it does so without any sensory input to the body, it has no physiological basis: Electricity makes the muscle respond directly but this does not teach the patient anything nor form any neuronal pathways that might be useful to the patient later on. It is useful in edema of the hands and in preventing fixed contractures.

(e) Exercise is the major form of treatment in stroke cases. However, this covers a broad field and is somewhat like saying that a good diet is the remedy for malnutrition. What is a good diet, and what is appropriate exercise?

Much of the usual exercise treatment of patients with stroke is the application of techniques used in other neuromuscular diseases, mainly poliomyelitis—passive exercise if the patient is too weak to perform any movement, assisted active exercise if he can participate partially in the movement, and active exercise for those who can carry out the full movement against gravity. This may be satisfactory

in the treatment of peripheral nerve disease but it is of very little value in the treatment of central nervous system disease with motor involvement. The therapeutic exercise program has been undergoing a transition owing to better knowledge of more basic neurophysiologic features and in recognition of limited success in treating patients with new techniques. The techniques are based upon either a facilitation or an inhibition of the steady bombardment of impulses to the involved muscle groups, plus the use of sensory stimuli for the direction and control of muscle responses. They are still being tried out and refined. In general, they may be summarized as the sensorimotor learning in the training of patients after stroke.

In prescribing physical treatment to be carried out by nursing and therapy personnel, one still has to fall back upon passive exercise to maintain joint range. If joints are not moved, painful contractures may occur, particularly in the shoulder joint. The passive motion is more preventive than therapeutic, for it does not require the patient to do anything. Ideally, such exercise should be carried on by the patient himself, but in the usual circumstances it is not possible, particularly in the first few weeks.

The second simple step is to place the involved limb or segment of the body in a favorable position for activity. For example, the first muscle to return in the lower extremity is usually the adductor and internal rotator. If the hip is placed in the extended position on the bed, as is usual, it is impossible to test for return of strength to this muscle or to encourage its activity. However, if the hip and knee are flexed and the ankle stabilized, then the patient can begin to move his knee laterally and medially to regain these simple movements. Similarly, if the patient is to regain hip extension, the knee and hip should not be acutely flexed but should be put in such a position that it takes a minimal voluntary effort to innervate this muscle.

As far as the arm is concerned, similar positions must be found at which some voluntary innervation can be elicited. For example: The patient might be able to initiate elbow flexion only if the arm is placed in internal rotation and with the elbow extended to 150°. Likewise, elbow extension might best be accomplished with the patient lying on his back with the arm in 90° elevation and the elbow at 90°. Sometimes it is best to pull the elbow into full extension and see if the antigravity impulses will keep the elbow from falling down to hit the patient in the face. One caution is that these maneuvers should not be repeated ad infinitum once the patient is able to do them, lest a fixed pattern be established. It must be recognized that they are only the beginning phases of muscle reeducation and training.

Most patients have some difficulty in holding the trunk in balance. When sitting on the edge of the bed or in a chair they tend to fall, usually to their involved side, as if they have no awareness of overcompensating to their good side. There is an actual loss of the righting reflex in these cases which is not a matter of muscle paralysis of the trunk, and until sitting balance is learned, standing balance and ambulation will be impossible. As a beginning, it is helpful to have the patient fix his eyes on one object or to lean on his involved side but never to pull with his hand to his good side.

Getting the patient out of bed early, sometimes within three days after stroke occurs, is a good means of restoring early balance if the patient is not too fatigued or otherwise in medical straits. Early standing, if it involves bearing weight on the involved extremity, is an excellent means of restoring strength to the extensor muscles of the trunk and legs. However, it is necessary that weight be borne upon the involved extremity and not upon the remaining good extremity if the greatest value is to be obtained. There must be a sensory input stimulation through the sole of the foot and various joints of the extremity in order to stimulate contraction in the extensor muscles, which are necessary for standing. The use of a tilt-table, knee splints and other leg and hip splints is valuable in starting this early training. It is true that there is some disadvantage to restoring too much power to the calf group or the plantar flexors of the foot, but this can be taken care of by means of bracing or surgical operation, provided the patient has enough tone in his knee and hip extensors to maintain the body erect.

AMBULATION AND EXERCISE

Early ambulation is also desirable. Ideally, for ambulation the patient should have good sitting balance and some standing balance and whatever stabilization is necessary for the foot or knee. Approximately 50 per cent of patients require short leg braces to get proper stability of the foot in order to carry out standing in the early stages. Some require these braces permanently unless other means are used to stabilize or balance the foot.

Besides putting the patient in a standing and walking position, a program of gymnasium exercises should be carried out if at all feasible, considering the age and debility of the patient. Exercises may include rolling on a mat, balancing on forearms and knees and balancing on hands and knees if at all possible. For the latter position an elbow extension splint on the involved extremity may be necessary. Kneeling balance and shifting of weight during kneeling is also valuable for teaching accommodation to weight shifting. These exer-

cises are functional exercises and not for individual muscles or joints. To do them, many muscles must contract and patterns of movement must occur. They must be repeated over a long period but they are far superior to any program of so-called bed or table exercises. Since the ability to stand and to walk in some fashion depends simply on an ability to hold the leg rigid, ambulation is a fairly easy goal.

The recovery of hand function is much more difficult and the prognosis much less favorable. In many medical centers that deal with rehabilitation after stroke, very little attention—except for measures to prevent contracture—is paid to restoration of hand function. Instead, stress is laid upon retraining the patient to use the remaining hand for all activities, the effect of which is to teach him to be a one-handed person. The reason for this emphasis on the unaffected hand is that “hand function” involves not only the hand but the entire upper extremity—the scapula, glenohumeral joint, elbow joint, forearm, wrist, fingers and thumb. Any coordinated movement involving reach, grasp, release and pinch, calls for interaction of all the muscles of these structures and the restoration of all of them is not very likely. The crude, uninhibited pattern of movement which returns is one of a synergy of antigravity movements involving adduction and internal rotation of the shoulder, flexion of the elbow, pronation of the forearm and flexion of the fingers and thumb. Improvement of some of the muscles but not all of them does little good, since the distal and proximal muscles may never be restored enough to concert with the others in a smooth function. For example, a patient may be able to elevate his shoulder by rotating the scapula and fixing the glenohumeral joint, yet be able to do little with the arm. Or he may be able to accomplish simultaneous flexion of the fingers and elbow yet be unable to release whatever he grasps.

The retraining of the patient to use his remaining hand to accomplish all tasks, including all the fine skills, such as buttoning, eating, writing, dressing and toilet care, is usually assigned to the realm of occupational therapy.

A very valuable gauge for use in occupational therapy is the ability of the patient to carry through some repetitive task. This is a form of test of the mental damage, for some patients can carry on a fairly lucid conversation and show a total inability to carry through any sort of craft activity that is of a repetitive nature. They show little ability to learn anything of a craft nature, which indicates a basic damage to the learning processes. This is very significant in evaluation of the patient and in determining what kind of treatment he should have.

The appliances used for rehabilitation after stroke are attachments for the leg or hand. Sometimes in the early stages a knee splint is necessary to give stabilization to the joint. Usually it can soon be discarded. Usually needed and for longer periods is a short leg brace to stabilize the ankle and thus prevent the plantar flexion-inversion pattern. Several kinds are available for dealing with various degrees of spasticity. Some patients would rather drag their foot than wear an attachment. Hand splints are seldom useful, except sometimes to prevent contracture of various muscle groups. They are of practically no functional value.

Recently there has been reviving interest in orthopedic surgical operations to help restore some of the function in the leg or the hand. These procedures are directed in the main to the motor components of the sensorimotor arc of neuromuscular

action—the lengthening of tendons or total tenotomy or interruption of motor nerve supply. It would be far better if it were possible to lessen directly the number of sensory impulses which, remaining uninhibited, cause overactive motor response. However, there is no surgical means for doing this and the motor approach is the only one available. In some cases of plantar flexion-inversion, balance of the foot may be promoted by tenotomy or lengthening of the heel cord, by sectioning of the posterior tibial tendon or by transplantation of the posterior tibial tendon anteriorly. Similarly in the hand, tenotomy or lengthening of the flexor tendons may weaken them enough to bring them into balance with the extensor tendons. Experience in dealing with hemiplegia is prerequisite to selection of patients for orthopedic operation.

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